Serangga 20(1): 13-21
ISSN 1394-5130 © 2015, Centre for Insects Systematic,
Universiti Kebangsaan Malaysia

INSECTICIDAL AND ANTIFEEDANT ACTIVITY OF *MOMORDICA CHARANTIA* AQUEOUS EXTRACT AGAINST CUTWORM, *SPODOPTERA LITURA*(F.) (LEPIDOPTERA: NOCTUIDAE) LARVAE

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ABSTRACT

Antifeedant activity of aqueous extract of *Momordica charantia* (Cucurbitaceae) leaf or commonly known as 'peria katak' was tested on early 4th instar larvae of *Spodoptera litura*. The preliminary study was carried out to investigate the effect of feeding activity on body weight of *S.litura*. From the study, the early 4th larval instar was fed with fresh leaves of *M. charantia*as well as fresh leaves of cabbage used as a control. The larvae fed on *M. charantia* leaves showed a high percentage value of reduction in weight, which is 91.81% after feeding at day-7. The aqueous extract of *M. charantia* was then prepared to determine the deterrent feeding activity of the larvae. The deterrent feeding activity is count based on percentage of

starvation index (Percent starvation = (C-E) / (C-S) x 100; Where: C = Mean weight gain of control larvae within 24 hours, E = Mean weight gain of treated larvae at each tested concentration within 24 hours, S = Mean weight gain of starved control larvae within 24 hours). The 100% concentration of extracts was tested. From the experiment, the extract exhibited a significant antifeedant activity at the LC_{50} levels. We found that the extract of *M. charantia* has antifeedant activity against *S. litura* larvae, where 100% concentration gave 57.02% of starvation index.

Keywords: Crude extract, antifeedant, *Spodoptera litura*, *Momordica charantia*

ABSTRAK

Aktiviti tidak makan terhadap ekstrak daun *Momordica charantia* (Cucurbitaceae) dikaji pada larva di awal instar ke-4 *Spodoptera litura*. Kajian tinjauan telah dijalankan untuk mengkaji kesan aktiviti pemakanan terhadap berat *S. litura*. larva di awal instar ke-4 diberi makan daun segar *M. charantia* dan daun segar kubis digunakan sebagai kawalan. Larva yang diberi daun *M. charantia* menunjukkan peratusan nilai pengurangan berat yang tinggi dengan bacaan 91.81% selepas makan pada hari ke-7. Ekstrak akueus *M. charantia* disediakan untuk mengenal pasti faktor pencegah terhadap aktiviti pemakanan larva. Pencegahan terhadap aktiviti pemakanan dikira berdasarkan indeks kebuluran (Peratusan kebuluran= (C-E) / (C-S) x 100; dimana: C= Purata kenaikan berat larva kawalan dalam 24 jam, E= Purata kenaikan berat larva yang diuji dengan kepekatan setiap ujian dalam 24 jam, S= Purata kenaikan berat larva yang kebuluran dalam 24 jam). Kepekatan 100% ekstrak diuji. Daripada kajian, ekstrak menunjukkan aktiviti tidak makan pada paras LC_{50}. Kajian membuktikan ekstrak *M. charantia* menyebabkan aktiviti tidak makan larva *S.*

litura pada kepekatan 100% dengan bacaan indeks kebuluran sebanyak 57.02%.

Kata kunci: Ekstrak mentah, aktiviti tidak makan, *Spodoptera litura*, *Momordica charantia*.

INTRODUCTION

Recently, the use of synthetic insecticides in agriculture is heavily practised by growers and this has given reversed affected to the users and consumers. However, their promiscous usage in the field had facilitated in development of insect resistance in the country and caused serious human health and environmental problems. Therefore it is extremely necessary to identify the effective, cheap and environmentally non-hazardous compound other than synthetic pesticides to manage crop pests. Plants synthesis are known to store a variety of secondary metabolites used in plants' defense mechanism against fungi, bacteria, virus and insects attack. One category of such defense substance in the plant is antifeedant. Antifeedants is defined as a chemical that inhibits feeding behaviour of the insect by releasing an unfavourable taste to the leaves (food) and cause dying through starvation (Katsura, 1977). Since antifeedants do not directly cause death to the insect pests, they are potential to regulate the economical and ecological damage of the crops caused by the pests. Hence, plant extracts have played an important role in this aspect (Mahadevan, 1982).

Many of the reported tropical plants were scrutinized, leading to extraction and characterization of their active constituents such as alkaloids, terpenoids, steroids, phenols, saponins and tannins chemicals (Wink, 1993). These active constituents can serve as alternative sources of insect pest control agents. One of such tropical plant is *Momordica charantia* (Family: Cucurbitaceae) or locally known as peria katak. *M. charantia* embedded momordicin I and II (Ling, 2008) which are the key action for controlling insect pest. But

there was no report on antifeedant activity of *M. charantia* aqueous extracts against *Spodoptera litura* which is a major pest of melon, banana, cotton and cruciferious vegetable crops.In this research, we proposed to evaluate the botanical extract that help to control the important pest of vegetable especially cabbage, *Brassica* sp. which is *Spodoptera litura*.

MATERIALS AND METHOD

Plant materials

Momordica charantia was obtained from the field of Horticulture research centre, Malaysia Agriculture Research and Development Institite (MARDI) Sintok Station, Kedah, Malaysia.

Insects cultures

Spodoptera litura were collected from the field, cultured on the fresh leaves of water-spinach and the food source (what is the food source?) were provided everyday to the larvae. The bioassay was conducted on the early 4th instar larvae of *S. litura* from a culture maintained at MARDI Bukit Tangga laboratory. Prior to using larvae in the various bioassays, they will be starved for 24 hrs.

Preparation of plant extracts

Aqueous extract of *M. charantia* was prepared by drying the leaves at 40 ^{o}C for 5-6 h. The dried leaves were ground and 300 g powder obtained. The material was extracted in distilled water, shaking (120 rpm) 10 minutes and leaves overnight. The material was then filtered in in common filter paper Whatman no. 42 and then fine-filtered using a Millipore filters (Millipore 0.2 mm, www.waters.com) to remove particulate matter. Each extract was evaporated under vacuum at 40-50 ^{o}C. 1 g of the lyophilised material was dissolved in 100 ml distilled water (0.01g/ml) for the preparation of the aqueous extract.

Bioassay

Insecticidal activity

Insecticidal activity was tested through the percent reduction in body weight daily. This preliminary study was carried out to investigate the effect of feeding activity on body weight of *S.litura*. From the study, the early 4th larval instar was fed with fresh leaves of *M. charantia* and fresh leaves of *Brassica* sp. (cabbage) used as a control. Three replicates with ten larvae each were done for both plants. Larval weight was calculated daily using the starvation index formula as below:

$$\text{Percent reduction in weight daily} = 1 - \frac{\text{weight of larvae fed on plant with extract}}{\text{weight of larvae fed on control}} \times 100$$

Antifeedant assay

M. charantia extracts will be tested for their antifeedant activity.100 % concentration was prepared as the treatment. Cabbage leaf discs measuring 7 cm diameter were soaked in *M. charantia* extract t. The control were soaked in distilled water and place in small container. The leaf discs were air-dried before feeding the larvae. Three replicates for each treatment and 10 larvae for each replicate were used. Two hundred larvae were left without feeding during 24 hours, and their weight were recorded. The larvae were then fed on the leaf disc as mentioned above and reweighted after 24 hours. Percentage of starvation was calculated according to the formula by Moustafa (1969) and Abdel- Mageedd *et al*., (1975).

Percent starvation = (C-E) / (C-S) x 100

Where:

C = Mean weight gain of control larvae within 24 hours

E = Mean weight gain of treated larvae at each tested concentration within 24 hours

S = Mean weight gain of starved control larvae within 24 hours

RESULT AND DISCUSSION

Insecticidal activity:

Results on effect of fedding activity of cutworm larvae on *M. charantia* leaves are shown in Table 1. Result showed that larvae fed on cabbage (*Brassica* sp.) increased the 4th larval instar weight from 3.57 mg/larvae to 124.13 mg/larvae while larvae fed on *M. charantia* leaves had slightly increased from 2.80 mg/larvae to 10.17 mg/larvae. The same age of larval instar showed different body weight gain when feeding on two different food sources which is close to 12 times. Larvae fed on cabbage leaf reached the prepupal stage with 5 % mortality after 7 days while the larvae fed on *M. charantia* leaves continued to be 4th instar larval until the end of the experiment (how many days?). The result showed that the percent reduction in weight increase from 41.99 % on day 1 up to 91.81 % an day 7. The larvae was observed not feeding on the *M. charantia* leaves provided in the container and become weak without food source. It is noticeable that the larvae were starved and refuse to eat *M. charantia* leaves which proved that *M. charantia* has insecticidal effect against *S.litura*.

Table 1. Effect on mean weight of early 4th instar larvae of *Spodoptera litura* fed on *M. charantia* leaves.

Time	Weight (mg) of larva fed on		% Reduction in weight
	Control	*Momordica charantia* (Peria katak)	
Day 1	6.80	3.94	41.99
Day 2	14.63	4.39	70.01
Day 3	22.47	5.01	77.71
Day 4	32.53	5.84	82.04
Day 5	53.00	6.44	87.84
Day 6	87.63	11.33	87.07
Day 7	124.13	10.17	91.81

Antifeeding effect:

Data in Table 2 shows that 100% concentration of *M. charantia* aqueous extract produces 57.02% starvation. The body weight of *S. litura* increased 7.93 mg/larvae in 24 hours in control treatment but slightly increase from 7.53 mg to 11.4 mg which is an increasing of 3.87mg per larvae in *M. charantia* extract in same period. The value of percent of starvation indicates that the larvae exposed to *M. charantia* extract reduce the portion of food intake and starved the insect.

This study also confirmed that *M. charantia* aqueous extract has active constituents' that lead to antifeedant effect against *S. litura*. This finding agrees with previous researchers who proved that *M. charantia* has momordicin I and II (Ling, 2008). *M. charantia* was reported to have the biological activity against *Plutella xylostella* (Ling, 2008). Moreover, the chemical constituents of plants such as alkaloids, flavonoids, sterols, terpenes and tannins proved by many authors to cause antifeedant effect to insect species (Salama *et al*., 1971; Salama and Sharby, 1988) but not to the specialists feeding that particular plants.

Table 2. Effect of *M. charantia* aqueous extract on larval weight and percent starvation of the 4th larval instar of *Spodoptera litura.*

Concentration of plant extract (%)	Average weight at zero time, mg/larva (A)	Average weight after 24 h, mg/larva (B)	Difference, mg/larva (B-A)	% Starvation
Control (C)	7.07	15	7.93	
Starved (S)	7.93	8.74	0.81	
Momordica charantia	7.53	11.4	3.87	57.02

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